

May 19, 1970

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3,512,438

STRIP STOCK FEEDING SYSTEM FOR PUNCH PRESS

Filed Dec. 11, 1967

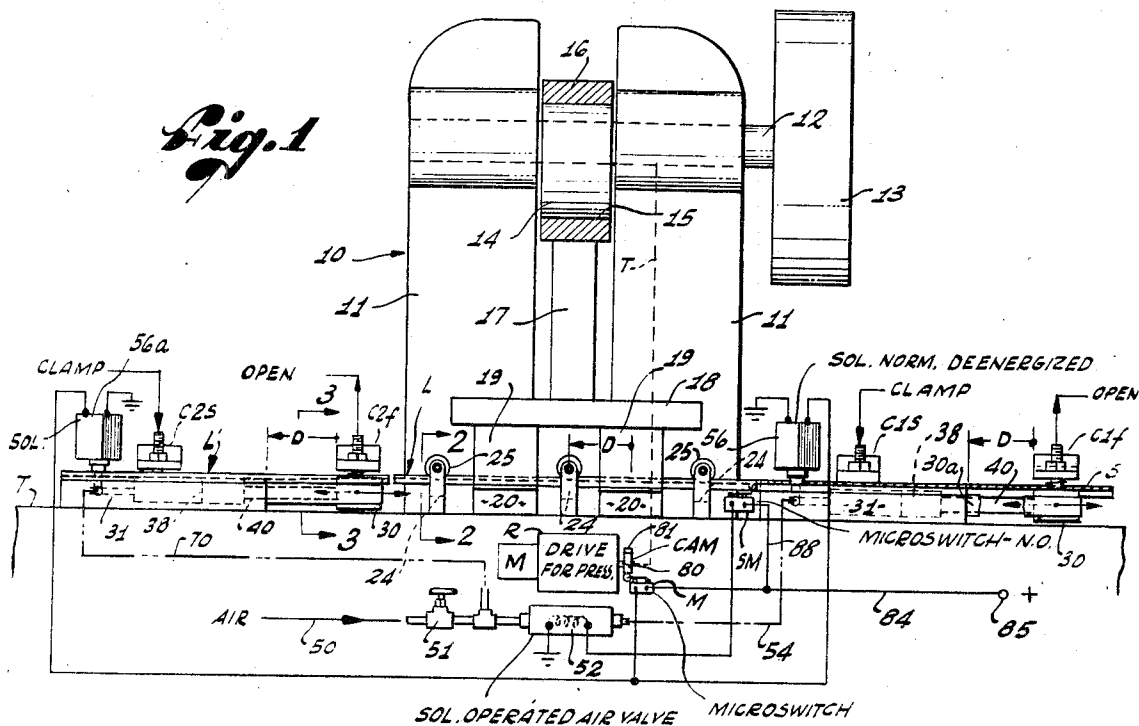


Fig. 2

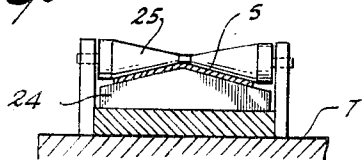


Fig. 3

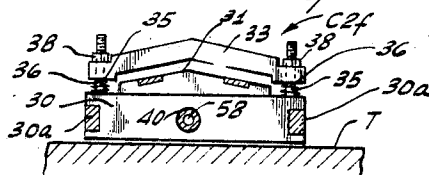


Fig. 4

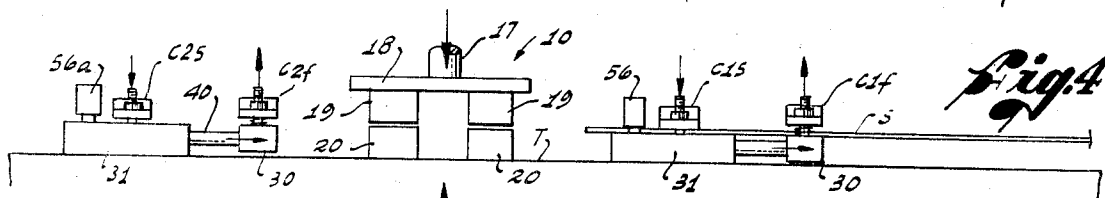


Fig. 5

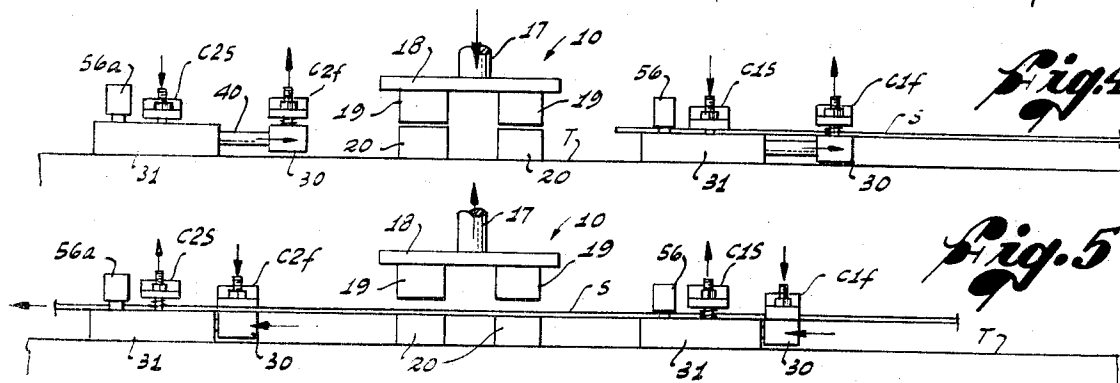
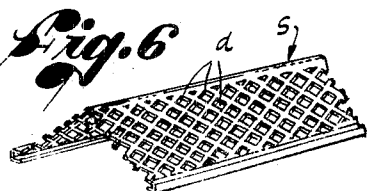


Fig. 6



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STRIP STOCK FEEDING SYSTEM FOR PUNCH PRESS

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Filed Dec. 11, 1967, Ser. No. 689,674

Int. Cl. B26d 5/22

U.S. Cl. 83—209

1 Claim

ABSTRACT OF THE DISCLOSURE

An outfeed system is provided for strip stock in a punch press. It is coordinated with a conventional infeed system, and affords a continuously operating punching system of high production rate having, on the infeed side of the press, an air powered reciprocating feed clamp for intermittently clamping and advancing the strip stock through a fixed distance, a stationary stock clamp on the infeed side of the press for clamping the strip stock alternately with the infeed clamp, in order to hold the stock steady for punching, and has, in addition, on the outfeed side of the punch press, a similar pair of feeding and stock or holding clamps for feeding the strip stock mechanically all of the way through the punch press, and at the same time permitting the strip stock to be punched for its entire length. The outfeed system permits automatic feed of successive strips, punching of each strip from end to end with mechanical indexing to and beyond the trailing end of each strip.

FIELD OF THE INVENTION

This invention relates generally to feed devices for feeding lengths of plastic strip stock or the like through a punch press, wherein the strips are advanced step by step, and punched in a predetermined pattern at a punching station during each stop interval.

The strip stock may be flat, or have various cross-sectional forms. In the present example, the strip stock is angular in cross section, comprising two flat flanges joined at an angle of 90°, with both flanges to be punched. The material in this case should be somewhat flexible, particularly at the junction of the flanges, to permit the latter to be spread to a larger and more convenient angle during the punching operation.

BACKGROUND

In the past, commonly known power punch infeeds have been available for feeding flat strip stock into a punch press. Such devices are manufactured by Mechanical Tool & Engineering Company, of Rockford, Ill., designated as Type 2, and make use of such punch press feeds as a basic component. With such feeds, however, there has been no feasible way known for mechanically feeding each successive strip all the way through the press. It has either been manually pulled from the machine, with measured stops (after passing beyond the infeed) to permit and to space successive punch strokes; or else attempts have been made to push the strip through by oncoming or next succeeding strip as the latter is advanced by the infeed. The infeed in these prior machines acts on the incoming strip through two normally open automatically actuated clamps. These include, first, an intermittently acting "feed" clamp which clamps the strip, then advances it towards the punch press by a predetermined indexing distance, and then releases it and returns to its initial position. Second, there is a holding or so-called stock clamp which clamps the strip rigidly during the time interval occurring between intermittent clamping en-

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gagements of the strip by the infeed clamp. The strip is held rigidly by this stock clamp during the punching operation. The cycle is then repeated. Both clamps in this system are on the ingoing side of the punch press, as earlier intimated. It will be seen that as the trailing end of the strip passes beyond the first mentioned clamp, i.e., the intermittently acting infeed clamp, there is nothing within the machine to continue the advance of the strip. It can of course be pulled step-by-step through and then out of the punch press by hand, between clampings by the stock clamp, and then after the stock clamp has been passed. Alternatively, and as sometimes attempted, a following strip has been fed in immediately behind each strip, and relied on to shove the preceding strip on through after the latter has passed beyond the reach of the infeed. However, in practice, this procedure did not work with satisfaction in all cases, since the strips sometimes became overlapped with one another, thereby jamming the operation. A satisfactory solution for this problem has not heretofore been available to my knowledge.

SUMMARY OF THE INVENTION

In accordance with the present invention, I provide additionally a second set of normally open feed and stock clamps located on the outgoing side of the punch press. The first of these encountered by a strip emerged from the punch press is an outfeed clamp which intermittently engages the strip and clamps it, then advances it through the predetermined indexing distance, then releases it, and returns to its initial position; and the second is a stock clamp, coordinated with the added outfeed clamp. The infeed clamp at the ingoing side of the punch press feeds the strip far enough to come within the range of the added outfeed clamp at the outgoing side of the punch press. The outfeed clamp at the outgoing side of the punch press thereupon intermittently engages the strip and feeds it forwardly by the indexing distance. The added stock clamp at the outgoing end of the punch press receives the strip before or by the time the strip has left the position of the stock clamp at the ingoing end of the punch press. Accordingly, as the strip is further punched and advanced, it is intermittently clamped by the stock clamp at the outgoing side of the press. Thus, a strip of material to be punched is moved automatically, in a succession of steps, entirely through the punch press, and can be punched continuously along its full length by a machine controlled indexing distance. Moreover, the strip passes automatically through the entire machine, and can be removed by hand or by other means as it emerges, fully punched, from the apparatus.

DESCRIPTION OF FIGURES

The invention will be further understood from the following detailed description taken in connection with the accompanying drawings showing an illustrative embodiment of the invention, and in which:

FIG. 1 is a largely diagrammatic side elevational view of a punch press equipped with the improvements of the present invention;

FIG. 2 is a section taken on line 2—2 of FIG. 1;

FIG. 3 is a section taken in accordance with line 3—3 on FIG. 1;

FIG. 4 is a diagrammatic view showing a position in the operation of the feeding equipment of the invention corresponding to FIG. 1;

FIG. 5 is a view similar to FIG. 4 but showing a subsequent position; and

FIG. 6 is a fragmentary perspective view of strip stock of angular cross section punched with illustrative dia-

mond shaped slots in accordance with the machine and process of the invention.

DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

Referring now to FIG. 1, a conventional punch press is designated generally by the numeral 10. This punch press has two laterally spaced standards 11, understood normally to rise from the floor, and in the upper ends of these standards is journaled a shaft 12 driven by a schematically designated motor M, reduction gear R, and one-to-one ratio transmission means diagrammatically indicated at T (FIG. 1). Shaft 12 carries a fly wheel 13, and has between standards 11 an eccentric 14 which works in a horizontally elongated slot 15 in a cross head 16. The latter is on the end of a vertically reciprocating connecting rod 17, constrained by means not shown for vertical travel, and on the lower end of shaft 17 is a cross head 18 bearing, on its underside, a pair of sequential punches 19 spaced apart as shown. On the undersides of the punches 19 are punch elements (not shown) of any kind desired and which in this case may be assumed to be diamond shaped, to punch diamond shaped slots and as seen in FIG. 6. The nature of the punch elements is not germane to the present invention and need not be detailed. For present purposes the elements 19 may be regarded as punches, bearing on the bottoms thereof punch elements (not shown) designed to punch openings in any pattern that may be desired in any give case. Below the punches 19, and mounted on a table generally designated at T, are die-blocks 20 having die openings, not shown, corresponding to the pattern of punch elements on the undersides of the punches 19.

A feature of the punch press is that each successive area of each strip S of stock is punched twice, once by the punch elements on punch 19 throughout an elongated area equal in length to the indexing distance D, and subsequently, after two steps forward, by intervening punch elements necessary to be forced through the stock on each punching stroke is thus halved, to obvious advantage.

At three positions, in between the punches 19, just ahead of the first punch 19, and just beyond the second punch 19, are pairs of guides 24 and guide rollers 25, shaped to spread the present illustrative normally 90° angle stock strips S as this stock moves over the guide and under the rollers. The stock is punched in this position by the punches 19. As seen in FIG. 2, the rollers 25 and the guide 24 are mounted suitably on the table T.

A length L of said stock is seen in the punch press, within but unclamped by the first or infeed clamp C1f, and just short of outfeed clamp C2f. Another length L', already punched from end to end, is shown as clamped by normally open stock clamp C2s, and is about to be released thereby, and clamped by outfeed clamp C2f.

In the present embodiment of the invention, the strip stock S (here of angle section) is fed in from the right, as seen in FIG. 1, and passes sequentially through an intermittent infeed clamp C1f, then through a stock clamp C1s on the infeed side, adapted to grip the stock for punching between advancements, then through the punch area, and thereafter through an intermittent outfeed clamp C2f, on the outfeed side, and finally through an outfeed stock clamp C2s.

FIG. 3 is a sectional view through a clamp, and is generally representative of either a feed clamp or a stock clamp, on either the infeed or outfeed sides of the punch, an outfeed clamp being specifically shown in this case. A base or housing 30 above table T has at the top a clamp plate 31, of the same obtuse angle shape as the aforementioned guide 24, and accordingly, conforms to the angle-shaped stock S when the latter is spread to its obtuse angle punching position. Over the plate 31 is a movable clamp plate 33, of the same obtuse-angle conformation, and the ends of this clamp member 33 are bored to pass piston rods 35 extending down into where there are

pneumatic piston devices, not shown because of their conventional nature, for pulling them down at predetermined times in the operating cycle. Coil springs 36 surround the rods 35 between the clamp plate 33 and the base 30, and thus bias the clamp normally to open position. The upper portions of the rods, above the member 33, are here shown as screw-threaded, and furnished with nuts 38 to set the clamps in adjusted positions. When the stock S is to be clamped, air valve and piston devices within the base 30 of a character well known in the aforementioned Rapidair feed, operate to move the pins 35 and clamp plate 33 downwardly to clamp the stock (not shown in FIG. 3) downward against the angular plate 31. Assuming the clamp to be a stock clamp, the stock is thereby clamped while being punched, and is subsequently released by upward movement of the rods 35 under the influence of the bias springs. Assuming the clamp shown in FIG. 2 to be representative of a feed clamp, the stock is first clamped by downward movement of the rods 35 and plate 33, is then advanced, as from the position shown in FIG. 1 through the indexing distance D, whereafter the rods 35 rise to unclamp the stock, under the influence of the bias springs, and the clamp returns to the position shown in FIG. 1. These movements are determined and controlled automatically by well known devices contained within the clamp bases, these being designated generally at 30 for the clamp bases under the feed clamps, and at 31 for the bases under the stock clamps. Control devices for operating the feed and stock clamps at the ingoing side of the machine are known in the Rapidair machine described hereinabove, and need not be detailed herein as they now may be regarded as conventional. Corresponding components are provided for the stock and feed clamps on the outgoing side of the machine, but these are controlled and synchronized with the first-mentioned feed and stock clamps to give a unique overall performance, with an increase in production rate of the order of a thousand times.

The base members 30 of the feed clamps travel as reciprocating slide blocks which slide in suitable ways, afforded as by rails 30a understood to extend from the stationary base members 31 towards and from the base members 31. A piston or plunger 38 inside each of the members 31 is connected by a connecting rod such as 40 to the base member or slide block 30. The piston 38 under suitable control from pneumatic air flow means and valving, comprise the means for reciprocating the feed clamps through the paths described, and for an understanding of the details of this mechanism, reference is directed to the conventional and commercial Rapidair feed now well known in the art, and requiring no further description in this specification.

Leaving control and synchronizing equipment for description until later, and assuming two strips or lengths L and L' of stock S to be in the punch press in the successive positions shown in FIG. 1 (see also FIG. 4), the sequence of operations is as follows: In the present embodiment of the invention, the stock is fed in from the right. The clamps are biased normally open to permit this. With reference first to FIGS. 1 and 4, the machine is shown in a selected position of the operating cycle with the stock clamp C1s closed in clamping position on L and with the infeed clamp C1f open, and retracted to its rightward or beginning position. At this same time, outfeed clamp C2f is in open position and retracted, while stock clamp C2s is closed on L'. The two pairs of stock and feed clamps operate synchronously with one another. The eccentric, push rod 17, and punches are down in the position of FIG. 1 at the completion of a punching stroke.

Feed clamps C1f and C2f next close and clamp the stock strips L and L', while stock clamps C1s and C2s open. Eccentric 14 elevates the punches, so the strips can be advanced. Base members 30 on both sides of the press, together with their respective feed clamps C1f and

the strips L and L' clamped thereby, are then advanced the indexing distance D, as to the position of FIG. 5, at which time feed clamps C1f and C2f, open, by elevation of their piston rods 35, with the biasing influence of springs 36, and stock clamps C1s and C2s close, by lowering of the corresponding piston rods 35, to hold the stock firmly and stationarily. The infeed and outfeed clamps return to the initial open position of FIG. 1. The punching stroke occurs at this time, as the eccentric 14 moves down. Stock clamp C2s at this moment is clamping already punched strip length L' and is about to release it, while outfeed clamp C2f is about to clamp it and then advance it the indexing distance D. Concurrently, the parts being still in the position of FIG. 1, stock clamp C1s is clamping partially punched strip length L, and is about to release it, while feed clamp C1f is about to clamp length L and then advance it the indexing distance D.

As explained earlier, the two punches 19 have intervening punch elements so that half the pattern is punched by the first punch, and the remainder by the second. It will also be easily seen that a given area of the punch, equal to distance D, is first punched by the first punch 19; in the second punch stroke, this area is between the two punches; and on the third punch stroke, the given area is punched in intervening locations by the punch elements of the second punch 19.

It will also be seen that the clamping mechanism at the right of the punch press advances the strip L through the punch press. On the next advancement beyond that which has carried the strip L to the position shown in FIG. 1, the strip L will be positioned within the outfeed clamp C2f, and will thereafter be advanced by the latter. The second strip L can be depended upon in this phase of the operation to shove the strip L' ahead of it, until the latter is removed by hand or otherwise. As the strip L advances intermittently beyond the position where it is first clamped by the outfeed clamp C2f, it finally passes beyond the location of infeed side stock clamp C1s; and, thereafter, the outfeed side stock clamp C2s intermittently grips the strip L to hold it steady while being punched.

Successive strips are thus passed intermittently through the machine, punched in a continuous pattern, and delivered from the machine, in a continuous operation, which can take place reliably at a higher order of speed and uniformity than has heretofore been known.

Suitable control equipment will next be described.

Incoming air under pressure is delivered via pipe 50 to hand valve 51, and beyond the latter, goes to an air valve 52 opened by energization of a control system solenoid housed therewithin. Beyond valve 52, an air pipe 54 goes to a pneumatically operated solenoid-controlled valve system for operating the infeed clamp C1f and stock clamp C1s. This air pipe or line 54 is here shown as connected to base or housing 31, and the air flow is under the control of a solenoid 56. Momentary energization of this solenoid 56 results in valve-controlled air flows which cause the stock clamp C1s and infeed clamp C1f to automatically go through one cycle of the infeed events as described earlier. As mentioned earlier, this pneumatic system is known in the art, and is sold under the trademark Rapidair. Only a portion of its parts are therefore here indicated. It may be mentioned that air for operation of the infeed clamp passes from housing 31 to pneumatic devices in housing 30 via an air passage 58 in plunger 40 (FIG. 3). It is a characteristic of this system that the clamps always come to rest normally in the "up" position, the bias springs 36 serving this function. The energization of the solenoid, which starts operation of the infeed mechanism, will be described presently.

The outfeed and stock clamps C2f and C2s, added by the present invention, are powered pneumatically by air via a line 70, taking off between valves 51 and 52, and thus not under control of the solenoid valve 52 which

controls the air to the clamps C1f and C1s on the infeed side. This line 70 goes to the stationary base 31 on the outfeed side of the press, and is under the control of a solenoid 56a, corresponding to the solenoid 56. Thus, with air valve 51 open, the energized solenoid 56a results in valve-controlled air flows which cause the stock clamp C2s and outfeed clamp C2f to undergo one cycle of the events for these clamps as described earlier.

The energization of the solenoids 56 and 56a at proper times is accomplished as follows: The output drive shaft 80 from the reduction gear R carries a cam 81 which periodically, once each revolution of the press drive shaft 12, closes a microswitch M. Thereby, an electric circuit 84 is closed from a source of potential 85, through the microswitch M, and through both solenoids 56 and 56a, in parallel, to ground. If the punch press is in operation, this circuit closure will cause the outfeed clamps C2f and C2s to undergo their previously described cycle of events repeatedly, being restarted each time the microswitch M is energized by the cam 82.

The infeed clamps C1f and C2s will not be started, however, without another condition being fulfilled, namely, the presence of strip stock in the press. A microswitch SM supported on table T at the infeed side of the press is engaged by the end of an incoming strip of stock S and moved to close the circuit 88 that energizes the solenoid of the valve 52, thus feeding air through said valve to the pneumatic valve system in the infeed side base 31. This microswitch is held closed by the strip stock until the latter passes said switch, at which time the clamps C1f and C2s are deactivated, and come to rest in open position. The strip is then, however, within the reach of the outfeed clamps C2f and C2s, which take the strip on through.

The completely mechanized feeding system of the invention tremendously multiplies the capacity and output of the punch press, as should be obvious.

A strip product presently being punched in accordance with the invention is shown in FIG. 6. Many other cross-sectional shapes and slot shapes may of course be devised and equally well used in the practice of the invention.

What is claimed is:

1. In a system for feeding lengths of strip stock through a punch press having reciprocating punch means and infeed and outfeed sides, and strip guide elements defining a rectilinear path for said strip from said infeed side to said outfeed side including an infeed portion in advance of said punch means, a punching station portion extending to and past said punch means, and an outfeed portion beyond said intermediate portion, the combination of:

a normally open feed clamp and a normally open stock clamp positioned in series along said infeed portion of said path;

a normally open feed clamp and a normally open stock clamp positioned in series along said outfeed portion of said path, the feed clamp and stock clamp on each of the infeed and outfeed portions of said path being cooperable in an operating cycle wherein the said feed clamp, from an open starting position, clamps strip stock extending therethrough, advances along said path to feed said stock a predetermined distance, unclamps said stock, and returns to said starting position, and said stock clamp clamps said stock during the interval in which said feed clamp is unclamped from said strip stock;

means timed by the reciprocating punch for synchronizing the operating cycles of the outfeed feed and stock clamps with the infeed feed and stock clamps, all in such manner that a length of strip stock introduced along said path is first intermittently advanced by said infeed clamp, and alternately thereafter clamped by said infeed stock clamp, is subsequently intermittently advanced by the outfeed clamp, and alternately therewith clamped by said infeed stock clamp, and is thereafter intermittently ad-

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vanced by said outfeed clamp, and alternately there-
with clamped by said outfeed stock clamp;
a pneumatic system for powering the clamping and strip
feeding events of said operating cycles of said clamps;
and
control means for said pneumatic system including
means initiating cyclic operation of the infeed clamp
and infeed stock clamp when strip stock in said infeed
portion of said path has advanced to a predetermined
point relative to said punching station, and also in-
cluding means for initiating cyclic operation of the
outfeed clamp and outfeed stock clamp irrespective
of presence of strip stock at any point along said
guide path.

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References Cited

UNITED STATES PATENTS

2,359,140	9/1944	Meitner	83—277	X
2,961,138	11/1960	Kaye	83—277	X
3,123,270	3/1964	Olson	226—162	X
3,125,270	3/1964	Ronfeldt	226—162	X

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U.S. Cl. X.R.

83—277; 226—115, 149, 162